A Place to Make, Hack, and Learn: Makerspaces in Australian Public Libraries

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Abstract

Content creation spaces, or 'makerspaces', are an emerging phenomenon in public libraries worldwide. This study investigated the current state of makerspaces in Australian public libraries. Qualitative interviews with three information professionals formed the data collection. Thematic analysis of interviews addressed the research questions: What are the issues and challenges of creating makerspaces within Australian public libraries? How can they be addressed? Findings revealed the substantive benefits of these spaces, including enhanced community engagement, development of a new form of 'library as third place', and transforming the library's image from one of consumption to one of creation. Additionally the study highlighted significant challenges to creating these spaces, including budgetary constraints, resistance to change within organisations, and proving the relevance of such spaces within a library context. The study provides suggestions to overcoming these obstacles and provides areas for further research in the area, including larger studies across a broader geographic area and further investigation and follow-up into upcoming programs within existing makerspaces.

Keywords: Makerspaces, Public Libraries, Content Creation, Fabrication

Implications for best practice

- Findings of this study have the potential to inform development and management of makerspaces in Australian public libraries. In particular, findings create awareness of benefits, challenges, and strategies for progression which may assist organisations in developing and managing makerspaces.
- Results from the study also highlight the changing role of libraries and how content creation spaces offer unique opportunities for increased community engagement. Collaborative partnerships with internal and external stakeholders combined with advocacy of new programs and spaces contribute to future-proofing libraries while supporting new directions for library services.

Introduction

As technology evolves and customer needs change, so is the role of the public library. Many libraries have adapted programming models to incorporate makerspaces, offering spaces for users to create, rather than just consume, content. In addition, these spaces provide opportunities for community engagement as members gather, collaborate, and socialise as they learn new skills.

In Australia, makerspaces and hackerspaces are becoming more prevalent, providing tools and spaces necessary for users to hack, make, tinker, and learn various skills and technologies. With numerous benefits for users and libraries alike, formation of makerspaces have the potential to improve library services. However, there are few programs hosted by Australian public libraries as compared to our overseas counterparts, with the majority of makerspaces occurring in the community sector and outside the public library domain. Conducting interviews with those currently managing or developing makerspaces in Australian public libraries sheds light on the current state of the movement, and the role

public libraries could play in its future. This research provides guidance in regard to benefits and challenges of developing makerspaces in Australian public libraries.

This paper commences with discussion of emerging literature in the area of makerspaces, followed by a description of methodology used, and an outline of data collection procedures. Results of the study are then presented with application of relevant literature, followed by limitations of the study. Finally, the paper concludes with implications and recommendations for further research.

The evolution of makerspaces

Public libraries have a long history of providing community spaces for creation (American Library Association 2013). These spaces traditionally catered for craft-focused activities like knitting, crochet and sewing. The evolution of technology and resurgence of a DIY (Do It Yourself) culture has led to a change in programming offered in some of these spaces moving to a focus on Science, Technology, Engineering, and Mathematics (STEM). These content creation spaces can go by a variety of terms, such as 'hackerspace' or 'tech labs' but are commonly referred to as 'makerspaces'. While the focus is often toward technology, makerspaces more generally concentrate on the notion of making, defined as 'a place where people come together to create and collaborate, to share resources, knowledge, and stuff' (Britton 2012, 30). They commonly involve 'a membership based location featuring workshops, tools, and people who generally like to make things' (Torrone 2011, para. 26), with the average makerspace user described as 'inventors, artists, entrepreneurs, crafters, and youth groups' (Belbin and Newcombe 2013, 2).

While physical representations of makerspaces can differ widely to include a large variety of subjects and materials, their purpose centres around similar goals:

1. To expand library services through increased technology offerings, spaces, and activities (Blowers 2012)
2. To foster community engagement, involvement, and participation (Herron 2012)
3. To encourage participatory learning (Hamilton 2012)
4. To promote equitable access to tools such as 3D printers, that would otherwise be off-limits (Britton 2012), and
5. To transform traditional understandings of libraries as places of consumption to places of creation (Ginsberg 2012).

The emergence of makerspaces in public libraries

Initially, many of these collaborative and creative spaces were associated with academic institutions. The first known fabrication space began in 2001 at the Massachusetts Institute of Technology (MIT) as 'an outreach project from MIT's Center for Bits and Atoms' (Fab Central, n.d). The idea then gained traction and spread worldwide, and began appearing in libraries. One of the first public libraries to incorporate makerspaces into its service model was Fayetteville Free Library (FFL) in New York in June 2012. The FFL Fabulous Laboratory, or 'FabLab' as it has come to be called, was created by librarian Lauren Britton-Smedley. She explains the purpose behind it as: 'Makerspaces are places where people come together to create, collaborate, and share resources and knowledge – an idea and concept that fits perfectly with the mission and vision of public libraries. Our patrons are not merely consumers of information, they are also creators of information' (2012). While there is some acknowledgement among librarians that initially 'the connection between libraries and makerspaces can be difficult to see' (Doctorow 2013 para. 12), the general consensus of the literature is largely supportive of the library makerspace movement. As Lankes (2013) explains, 'the mission of librarians is to improve society through facilitating knowledge creation in their communities' and as such those involved with the creation, management and development of makerspaces view them as a natural fit with the aims and missions of library services (Britton 2012).

Benefits and challenges of makerspaces in public libraries

A number of benefits and challenges have been identified with the introduction of makerspaces in public libraries. In regard to benefits, along with facilitating knowledge creation, makerspaces also align with other traditional library values. Providing equal opportunity to materials, information, and knowledge has been a longstanding tenet of public libraries. Housing materials such as 3D printers, 3D scanners, and other technologies within public institutions provides the community with equal opportunities for access (Anstice 2012). Additionally, makerspaces provide public libraries with the prospect of extending their relevance to a new set of users. Makerspace culture can connect with community members where more traditional library programming, like story time and book clubs, have failed (Anstice 2012).

While the majority of literature is quick to espouse the virtues of makerspaces in public libraries, there are still those who remain skeptical. Although advantages outweigh disadvantages, there are still shortcomings to consider. Anstice cites Groenedyk's explanation that makerspaces are not for every library and 'there's typically a set audience that they appeal to' (para. 6, 2012). He continues that if a public library does not have tech-savvy users interested in using the space, there is no reason to provide it. Furthermore, in times of reduced funding and uncertain budgets, makerspaces can seem an expensive indulgence. For some libraries, initial investments required to set up a makerspace can prove a barrier to their implementation (Greenwalt 2012, 16). However, many makerspaces aren't necessarily technology focused, and can be low-cost.

Currently, the overwhelming majority of research into makerspaces has been conducted in the United States. There is little research as it pertains to makerspaces in Australia. This paper aims to contribute to the conversation by focusing on the makerspace movement in Australian public libraries.

Research Aims and Objectives

This research endeavoured to gain an understanding of the current state of makerspaces in Australian public libraries. More specifically, the study aimed to describe current practices in developing and hosting makerspaces and other content creation to address the research question: What are the issues and challenges of creating makerspaces within Australian public libraries?

Method

A semi-structured, qualitative interview protocol was selected as the research approach to best address research questions due to its focus on understanding the lived experiences of participants (Di-Cicco-Bloom and Crabtree 2006). In addition, qualitative interviewing is valuable to gain a better understanding of phenomena to contribute to the body of knowledge, particularly in emerging areas where there is little empirical literature (Di-Cicco-Bloom and Crabtree 2006).

This study involved interviews with three participants working in public libraries throughout Australia conducted in April-May 2012. Participants were either developing or managing a makerspace within their organisation. Two sites were traditional public library branches currently developing makerspaces, while the third was within a state library. Participants were recruited specifically due to their known involvement with developing and/or managing makerspaces in Australian public libraries. Further potential participants were approached and snowball sampling was attempted, however due to the limited nature of the makerspace movement within Australian public libraries and time constraints, the sample was limited to three participants.

Data Collection

Data was collected using a semi-structured, one-on-one interview protocol, based upon Kvale's *Seven Stages of an Interview Inquiry* (2007, 35-36). Two interviews were conducted using Skype and one in person. Interviews varied in length from 25 to 45 minutes and consisted of open-ended questions with follow-up questions arising from answers given.

Questions were designed to understand individual perceptions and experiences of developing and/or managing a makerspace and form consensus on typical issues that may arise with a focus on identifying common difficulties in providing creation spaces within public libraries. Participants were asked to describe personal experiences with managing and/or developing makerspaces, including associated benefits and challenges, and how these challenges were overcome. In addition, participants were asked to consider how these types of spaces might be further developed in Australian public libraries. Following an open-ended, conversational-style protocol (Kvale, 2007) allowed participants to provide an understanding of specific examples of makerspace development and/or management.

Data Analysis

Interviews were recorded and transcribed to allow for in-depth analysis. Thematic data anlaysis was employed to 'describe and develop themes from the data' and 'formulate a set of non overlapping themes' (Creswell 2012, 473). Participant responses were compared to develop categories of information with direct quotations provided for further explanation and clarity of the issues highlighted by the interview process.

Results

Three themes in regard to makerspaces within public libraries emerged: benefits of makerspaces, challenges and difficulties in development, and lessons learned for further progression. This section will explore each of these in detail.

Benefits of makerspace inclusion in public libraries

Although there were significant differences in participants' individual experiences, each described similar benefits provided by content creation spaces. These included community engagement, access to new technologies, new learning opportunities for users, and future-proofing the organisation.

The benefit each participant emphasised most was community engagement, with all three describing positive impacts on local communities arising as a result of the makerspace. Occurring on several levels, these spaces have provided opportunities for community members to engage in new technologies and connect with others over shared interests. Examples given included school age students; university students; retired engineers and industrial designers; and community members with interest in new technologies. Partnerships with universities and TAFE's, local schools, teachers' associations, and local hackerspaces were all cited as examples of new community connections made since the development of the makerspace. This is best exemplified by Participant 1:

> 'Even with the 3D printer, I've got a whole range of people wanting to get their hands on it. We've got university students, I've got kids from the school, I've got older community members who say, I want to look at this new tech and I used to be in industrial tech but I'm retired and I want to see what this is all about'.

One interviewee described some users of the makerspace who work for large corporations or government interests. They come with highly developed skills, and while they can't talk about a lot of the work they do, the makerspace affords them the chance to share their knowledge with others in a meaningful way:

> 'They love interacting in this makerspace and in this kind of a community because they actually have the opportunity of being a "real person" and interacting with a smile on their face and have some kind of emotive connection, emotional reaction, for them - that's the power' (Participant 2).

Another major benefit makerspaces provide is unfettered access to new technologies, which participants felt had multiple advantages. All three participants explained the attraction of items like 3D printers to bring in new library customers. They noted these technologies have important implications for the future, and would otherwise be impossible for the average user

to access. The technologies also contribute to providing a new space for users to participate in new learning opportunities. Participant 2 explained:

> 'For young people today who don't have that opportunity whether it's because of the density of urban living or current education model or current work practices, they don't have that culture of a shed where you go and you tinker on stuff. I think a makerspace fills that need, and I think it is a biological need, there is that curiosity that drives a lot of that need'.

Participant 3 shared similar notions when describing makerspace benefits. They discussed the benefit in educating people in technologies they don't have ready access to but will be more prominent and important in the future, mentioning 3D printers in particular and citing examples of advancement in the medical field using 3D printers to create new body parts.

It was also found the majority of participants believe makerspaces contribute to future proofing libraries (Participants 1 & 2). As the role of library services change, information professionals are charged with the task of aligning community needs with materials, services, and spaces they provide.

> 'We're at that point in libraries in general where we're trying to figure out what we are, like what is a library in this day and age, and I'm quite interested in the what's next sort of thing, and that's why it's kind of future proofing libraries.' (Participant 1).

Participant 2 reiterated this idea stating the use of makerspaces in libraries represents the 'changing shape' of libraries. In providing materials, technologies, and spaces, makerspaces offer new learning opportunities, increase community engagement, and enable equitable access appealing to a variety of users, all of which contribute to future proofing the organisation.

Challenges in developing makerspaces

While benefits of makerspaces have been clearly demonstrated both in literature and experiences of participants, significant challenges also accompany makerspace development in Australian public libraries. Interviewees identified these as the new nature of makerspaces as 'uncharted territory', budgetary constraints, and concerns over copyright, liability, and ownership.

As makerspaces in Australian public libraries are a relatively new phenomenon this has created a unique set of challenges for participants, who are often trying things for the very first time. Participants found it a particular challenge to translate the value and relevance of new and different programs and technologies to those who are used to a more traditional library model. Indeed, there was a steep learning curve for all staff involved with the makerspace. One participant in particular described the challenges in preparing to run a makerspace:

> 'All that research that's really been a very, very big challenge, a huge learning curve. Because while I've got really tech-savvy people here, this is not normal tech-savvy…it's not normal knowledge that people have' (Participant 3).

This challenges extends beyond staff to the community as well. All participants described the need for community support for the space as an absolute necessity as without it, there is no reason for a makerspace to exist. Similarly to staff reluctant to see change in their library, participants discussed some community members hesitant to embrace these more advanced technologies and the new direction of library programming.

Another challenge discussed by all three participants was budgetary constraints. While some funds were relatively simple for participants to procure, the changing nature of the technology and high cost of importing these items to Australia proved challenging. Two participants were able to secure seed amounts through grants and siphoning from unallocated funds that

required expending within their organisations. In addition, all three participants relied upon partnerships with other organisations to supplement limited budgets. With restricted funds, participants discussed the necessity to conduct significant research to ensure money was spent wisely. Participant 3 described this process as follows:

> 'You don't just on a whim say 'I'll go out and buy three laptops and a 3D printer and this video software and this animation software, you need to get the best things and the animation software has to be good for whatever PC you get.'

Finally, participants also discussed unique challenge brought to the forefront by content creation spaces regarding ownership of materials created at the library and legal implications. Two interviewees cited difficulties with the question of 'who owns what'. In addition, participants expressed concerns over liability and copyright associated with use of materials in the makerspace.

Participant 3 used the example of the gun created in the United States using a 3D printer to discuss the possible legal implications to consider in terms of what is created in the space, as well as how. Participant 3 described concerns as follows:

> 'It's not so straightforward as saying whatever you design and create has to abide by law, be legal, because technically speaking, it may be legal because there's a loophole somewhere. And somebody said to me what about building grenades? So there will be things that anyone developing a makerspace, not just libraries, they need to factor these kinds of things in if they have a 3D printer'.

Copyright restrictions and understanding legal implications were discussed as necessary to protect the library, but as Participant 3 described, is a grey area due to many gaps remaining in the law as it is untested owing to the newness of the technology.

Strategies for progressing makerspaces

Participants each discussed strategies for developing and progressing makerspaces based on their personal lessons. These included the importance of forging partnerships, the need for awareness and advocacy, and of the value of creating a successful blueprint for others.

For each organisation, forging partnerships with outside agencies was integral to connecting with communities and maintaining viability for the project. There have been several positive and diverse outcomes resulting from these partnerships including:

- partnerships enabling people from different ages, educational levels, and backgrounds to connect over similar interests (Participant 1)
- mutually beneficial exchanges between libraries and the community where for example local hackerspaces use the space providing them with access to technologies that might otherwise be inaccessible and also providing opportunities for staff and other users to learn from more experienced hackers and makers (Participant 2). Participant 3 also discussed a similar mutually beneficial exchange between the makerspace and university students.

Along with forging partnerships, research was discussed as another key tool in successful development of makerspaces. Having a thorough understanding of the community and their needs was considered important to determine whether or not creating a makerspace would be relevant. All three participants described the importance of an existing DIY and/or hacker culture to the success of their project. Explains Participant 1:

> 'If you had a community who can't swim and don't want to learn how to swim, and then you suddenly build a huge aquatic centre in the middle it's not going to be successful'.

Additionally, research was found to be beneficial in justifying the project as a whole. Familiarity with existing successful projects encouraged support from management and ensured the most applicable technologies were being purchased for the space.

Further to this, in order for a makerspace to be successful, there was acknowledgement that there needs to be awareness of benefits for the community. Participant 1 in particular described the need for relevancy of the project to be clearly promoted. They discussed this requires advocacy on behalf of library staff, and "validating that it's an activity that libraries can engage in" (Participant 1). As libraries continue to evolve and find their place within a community, successful makerspaces will need to be fully supported and promoted by staff as well as the community.

Finally, in supporting the further development and validation of makerspaces one participant described the importance of creating a blueprint of a successful makerspace for others to use. Participant 2 explained 'it is about doing it right and then giving it all away. I view it as if we manage to develop all these processes and safety procedures, protocols, just make them freely available'.

Discussion

Based on findings, the Australian public library experience of developing makerspaces is not dissimilar to experiences from overseas counterparts. The three themes exploring the benefits, challenges and future progress of makerspaces offer insights and lessons for others considering developing their own.

Engaging the community in new ways is assisting in future proofing libraries

The most significant benefit described by participants was higher levels of community engagement created by incorporating makerspaces. The traditional notion of libraries as a place for social gathering has been largely explored as 'library as third place' which 'provide physical places for human contact and social experience outside of the home or workplace/school' (Lawson 2004, 125). While the notion of libraries as a third place is not new, makerspaces significantly contribute to a new iteration of this concept. This aligns with statistical research conducted by the American Library Association, who reports US libraries with makerspaces are 'experiencing increased visits and demands as a result' (2013, para. 1) of their inclusion. As participants discussed the primary goal of these spaces as to promote higher levels of community engagement, the literature supports this idea of increased usage and successfully extending this 'third place'.

As these third spaces contribute to higher levels of community engagement, they are also 'future proofing' the organisation, as mentioned by participants and broadly discussed in literature. According to Harris, 'to remain relevant and sustainable it is important for libraries to focus on strategies to ensure libraries are destinations of choice, and not just a place' (2007, 148). Makerspaces provide a strategy for this, keeping pace with broader societal change and needs. Resnick and Rosenbaum explain, 'the Maker Movement builds upon a broader cultural shift toward a do-it-yourself (DIY) approach to life, where people take pride and pleasure in creating things personally rather than only consuming mass-produced goods' (n.d., para.1). Furthermore, makerspaces provide exposure to technologies and fabrication education that has been inaccessible to many library users. This has meaningful implications for a new generation of inventors and innovators, as recently there has been a 'drive toward interdisciplinary collaboration in industry, which requires informational and physical connectivity' (Foertsch, n.d, 5). As traditional fabrication and 'shop' classes dwindle, makerspaces can fill a necessary gap. This supports findings from all three participants, who described their experiences of providing DIY materials, technologies, and support.

Embracing the challenge of change, funding and unchartered territory

The second theme focused on challenges and difficulties associated with makerspace development and implementation. As a new phenomenon, much of the literature focuses on successes of these content creation spaces. Where challenges are discussed in literature it is evident they are similar to those experienced by participants where there is a distinct embracing of the challenges due to belief in the outcomes.

For those creating new spaces in their libraries, staff involvement and 'buy in' is integral to the success of reinventing roles and service models. Resistance to change within public institutions is an oft-cited problem, as written by Rowley (2011, 254): 'Unfortunately, there is evidence to suggest innovation and other entrepreneurial activity is often discouraged in public sector organizations'. Those successful in developing makerspaces, including participants in this study, have chosen to embrace the challenge as a way to encourage innovation (Hamilton, 2012). Supporting professional development among staff and incorporating successful change management models are a necessary element in developing makerspaces within public libraries (Cervone, 2011). Cervone (2011, 96) summarises Agocs' (1997) four core tactics to successfully promote change within an organisation, as follows:

- Create allies within the organisation: Garnering support from a few key individuals can help successfully promote change.
- Endorsing change: By explaining the reason for the change as well as the benefits of doing so, staff support is more assured.
- Utilising existing resources: Familiarity with current procedures and materials has multiple benefits, including support from upper management and cost reductions.
- Mobilising politically: Leveraging support from upper management is crucial to successful change, as well as gathering community support.

The above four strategies were described in some form across the three interviews as methods to help combat change resistance among staff. For organisations considering implementing makerspaces, knowledge of these tactics could prove useful.

Further to this, participants described budgetary constraints as a significant challenge due to high expense of technologies, programs, and staff as compared to overseas counterparts. In uncertain economic times, justifying expensive purchases to management may deter makerspace development. However, inspirational lessons can be learned by observing functional makerspaces during recession and stagnant economic growth. Case studies in literature confirm the ever-present challenge of balancing budgets with customer service needs. The Mt. Elliott Makerspace near Detroit, Michigan, is one such example. A city nearing bankruptcy and recently suffering a 25% decrease in population (Box, 2012, 3) has limited resources to build such a space. However, as an investment in the community, it has provided residents with tools to make, rather than buy, and contribute to their community (Box, 2012, 14). Indeed, literature suggests these spaces are perhaps most beneficial and necessary during times of economic hardship. Box (2012, 13) explains, 'the limited pallet of materials only adds to the design and social challenge of the neighborhood environment; a form must come from what resource is available locally'.

Similarly, all three interviewees viewed makerspaces as an investment in their community, rather than a one-off cost of purchasing materials and technology. As a result partnerships with local community, government agencies, and universities were considered extremely important with in some cases the added benefit of contributing to decreased costs. Other strategies to overcome budgetary constraints included volunteer instructors, donations, and tie-in to government resources (like the National Broadband Network) were also discussed to significantly reduce costs while simultaneously attracting users and promoting the space.

Finally, with an evolving mission, participants revealed difficulties with some of the undefined aspects of running a makerspace. While the rules are still being written, suggestions from literature include creating a set of ground rules to ensure an overall understanding of correct usage of the space. The 'Makerspace Playbook' focuses on defining for users five key areas: 'Purpose, Membership, Space Use, Emergencies, and Tools' (2013, 42). By establishing a shared knowledge of acceptable practices, makerspace managers can ensure negligible issues arise from usage of the space, and protect themselves from potential liability.

The necessity of awareness, advocacy and contributing to the movement

For those considering a makerspace, significant challenges of limited budgets and unchartered territory can be mitigated using various suggestions made by interviewees.

Literature confirms both the necessity and efficacy of awareness, advocacy and validation of new programs and service areas.

Participants cited advocacy of programs and spaces as integral to success. The American Library Association describes advocacy as 'turning passive support into educated action by stakeholders' (p. 1) and also includes 'public relations, public awareness, and intellectual freedom' (p.1). Abram writes however that: 'Libraries in particular are challenged with communicating our value and impact' (2013, 1) continuing on to say: 'we are at a tipping point of ensuring that we thrive and adapt to the changes in our digitally enhanced, knowledge-based economy' (1). Makerspaces within libraries then are in a unique position to advocate new and relevant programs, spaces, and service models. Participants agreed, noting the need for advocacy at several levels including management, staff, clientele, as well as the general public. The 'Makerspace Playbook' offers several suggestions to accomplish this advocacy through:

- 'Spreading the Idea' by sharing information with relevant stakeholders like schools, companies, and community centres (2013, 41),
- 'Identifying Student Makers' through recruitment of interested students in manageable numbers (2013, 42), and
- 'Setting up a website' as a low or no-cost method of promoting the space (2013, 42).

These suggestions were being followed through by participants in their development of partnerships and marketing through their organisation in particular.

This notion of awareness and advocacy is furthered through the desire of existing makerspaces to share resources for the development and progression of others. Participant 3 specifically cited the desire to create a blueprint for success to share with anyone interested in creating a makerspace of their own. This finding is in keeping with suggestions made by the 'Makerspace Playbook', whose authors write, 'It's not enough to just make something – it's also important to be able to tell others about the projects and why they're great' (2013, 45). The authors, as did participants implicitly, encourage those managing makerspaces to document (2013, 45) as well as to 'report and share' (2013, 48) with others involved in the makerspace movement particularly by 'sharing best practices' (2013, 48).

Limitations

The study was limited by several factors. The first is a small sample size. With only three participants interviewed, it was difficult to draw generalisations from given responses, instead findings represent insights. In addition, organisations represented by participants were in differing stages of development, which may have resulted in some discrepancies in responses. However, as makerspaces are new and emerging spaces in Australian libraries, this significantly limited the available sample size. Despite these limitations, the study provides some insights others may consider useful if considering establishing a makerspace and provides a foundation for further research into this space within Australian libraries.

Conclusion

Makerspaces are becoming increasingly prevalent in public libraries worldwide, and are an emerging phenomenon in Australia. Interviews with three information professionals currently managing and/or developing makerspaces highlighted the considerable benefits provided by these spaces including improved program and technological offerings, increased community engagement, and development of a new "third place". However, significant challenges were also identified to their successful implementation. In particular, budgetary constraints, resistance to change within organisations, and copyright issues are potential deterrents. A discussion of relevant literature applies potential solutions and techniques to mitigate these difficulties. Formation of collaborative partnerships with internal and external stakeholders and promoting advocacy for new spaces and programs were particularly highlighted as possible mitigation strategies. This study provides an understanding of issues relating to incorporation of makerspaces and may be useful in addressing challenges accompanying their implementation.

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